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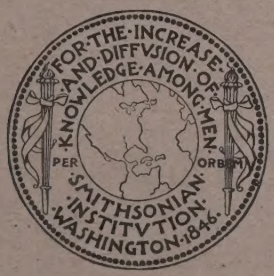
A REVIEW OF THE DISCOBOLOUS FISHES OF JAPAN.

BY

DAVID STARR JORDAN
AND
JOHN OTTERBEIN SNYDER,
Of the Leland Stanford Junior University.

From the Proceedings of the United States National Museum, Vol. XXIV, pages 343-351.

[No. 1259.]



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A REVIEW OF THE DISCOBOLOUS FISHES OF JAPAN.

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In the present paper is given a review of the Discoboli (*Cyclopteridæ* and *Liparididæ*) found in the waters of Japan. It is based on the collections made by the writers in 1900, on the collections in the United States National Museum, and on the collections of the United States Fish Commission steamer *Albatross* made during the same year, which have been deposited in the United States National Museum.

The Discoboli are degenerate cottiform fishes, characterized as such by the presence of the suborbital stay. From related families they are separated by the obsolete myodome, by the reduced ventrals united to form a sucking disk or altogether wanting, and by the little development of the spinous dorsal.

The two families are thus separated:

a. Body cavity large, caudal region short, skin prickly or smooth..Cyclopteridæ, I.
aa. Body cavity short, caudal region elongate, skin smooth.....Liparididæ, II.

Family I. CYCLOPTERIDÆ.

THE LUMP SUCKERS.

Body short and thick, more or less elevated, covered with a thick skin, which is smooth, tubercular, or spinous; head short and thick; suborbital stay present, thin and flattish; mouth small, terminal; jaws with bands of slender, simple teeth; no teeth on vomer or palatines; gill openings narrow, restricted to the sides, the membranes being broadly joined to the isthmus and shoulder girdle; branchiostegals 6; gills 3½; pseudobranchiæ present; dorsal fins 2, the anterior part of flexible spines, which, in the adult, are sometimes hidden by a fleshy hump, in one subfamily entirely wanting; soft dorsal usually opposite the anal and similar to it; caudal fin rounded, free from the dorsal and anal; ventrals thoracic, rudimentary, forming the bony center of a sucking disk; pectorals short, placed low, their bases broad and procurrent; pyloric cæca numerous; intestine elongate; vertebræ 12+16,

the skeleton feebly ossified. Northern seas of both hemispheres. By means of the adhesive ventral disk these fishes are enabled to attach themselves very firmly to rocks or other objects. They feed on crustacea, worms, small fishes, and plants. The young of *Cyclopterus* bear a close resemblance to *Liparis*, an evidence of the common origin of the 2 groups which is borne out by the anatomy.

Cyclopterinæ:

I. Spinous dorsal present, sometimes concealed in adult.

a. Barbels small or none; disk anterior, below the head.

b. Skin naked or with scattered slender spines; no lateral line. *Lethotremus*, 1.

Liparopsinæ:

II. Spinous dorsal wholly wanting.

a. Dorsal short, opposite anal, of 9 or 10 rays; skin wholly smooth, without bony tubercles ..... *Cyclopterichthys*, 2.

1. LETHOTREMUS Gilbert.

Lethotremus GILBERT, Rept. U. S. Fish Comm., 1893 (1896), p. 449 (*muticus*).

This genus differs from *Eumicrotremus* in the total absence of the bony plates and of a lateral line or pores on sides of head and body. The skin is smooth in the typical species.

The ventral disk is large, placed below the gill openings and base of pectoral. Barbels absent in the typical species, present in the Japanese. The body is almost spherical except for the short tail. The spinous dorsal is well developed. Gill opening very small. The genus is very close to *Cyclopteroides* from Bering Sea, differing chiefly in the absence of prickles and perhaps in the more anterior insertion of the ventral disk.

(λήθη, forgetfulness; τρῆμα, aperture.)

1. LETHOTREMUS AWÆ Jordan and Snyder, new species.

Head 2½ in length; depth 2; depth of caudal peduncle 3½ in head; length of snout 4; diameter of orbit 3½; width of interorbital space 2⅔; D. VI, 8; A. 7; P. 21.

The body is almost globular, the width about equal to the depth; the tail compressed posteriorly. Head large, snout short, the jaws about equal. Eye large, lateral, situated much nearer to snout than to gill opening, the preorbital area about equal to diameter of pupil; interorbital area broad and flat. Mouth somewhat oblique, the cleft extending backward to a perpendicular passing between pupil and anterior part of orbit; jaws with broad bands of close-set, blunt teeth. Gill opening narrow, located about midway between upper edge of base of pectoral and insertion of dorsal, the flap triangular in shape.

Skin smooth. A short barbel above eye, posterior to nostril; a long, slender barbel on lower jaw; a second, similar one at lower edge of

cheek, on a vertical passing between pupil and posterior edge of orbit; a third just posterior to angle of preopercle.

Dorsal fins 2, the first inserted immediately above gill opening; its rays enveloped in a thick, fleshy covering which almost completely conceals them; insertion of second dorsal a little in advance of anal, the rays of both fins with thin membranes, extending when depressed a little beyond base of caudal. Pectoral large, rounded posteriorly, its edge continuous. Ventral disk round, with a wide, free margin; its diameter contained $1\frac{2}{3}$ times in length of head.

Color in spirits, light brown, without spots or bands.

The species is known from specimens about 300 millimeters in length, from Kominato, in the province of Awa, at the mouth of Tokyo Bay.

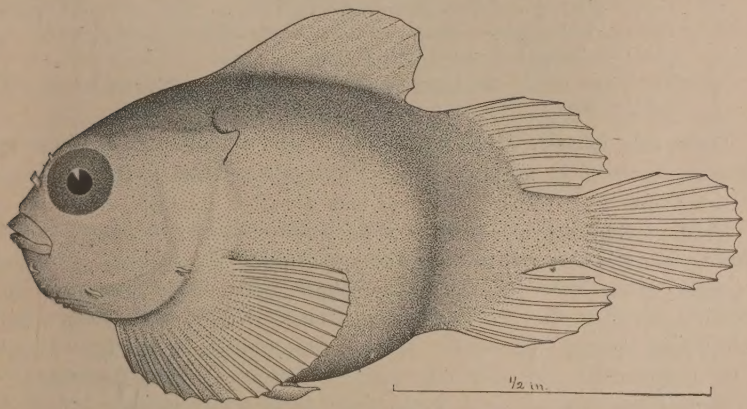

FIG. 1.—LETHOTREMUS AWÆ.

Type.—No. 6539, Leland Stanford Junior University Museum.

One of the cotypes differs from the specimen described in having a long, slender barbel over eye, posterior to nostril tube; a row of 4 small, slender barbels below eye; a row of 4—the first of which is shortest, the last being longest—extending from near mandibular symphysis posteriorly to opercle; a few minute barbels on upper posterior part of head.

The type and other specimens were presented to the university by Dr. Ishikawa. Similar examples are in the Imperial Museum of Tokyo, No. 629.

2. CYCLOPTERICHTHYS Steindachner.

Cyclopterichthys STEINDACHNER, Ichth. Beiträge, X, 1881, p. 14 (*glaber=ventricosus*).

Body short and thick, rounded, covered with thick, smooth skin, destitute of bony tubercles; tail slender, compressed, the body abruptly contracted to its base; head broad, obtuse; mouth oblique, the lower

jaw prominent; teeth rather small, simple, hooked, sharp, in 2 rows anteriorly; pseudobranchiæ large; gills 3½; suborbital connected by a bony stay with the preopercle; gill opening small, above the base of the pectoral, which is broad and procurrent; ventral disk moderate, fringed. Dorsal short and high, of soft rays only, opposite the short anal, both well separated from the small caudal. (*Cyclopterus*; *ἰχθύς*, fish.)

2. CYCLOPTERICHTHYS VENTRICOSUS Pallas.

Cyclopterus ventricosus Pallas, Spicilegia Zool., VII, 1769, p. 15, pl. II; Kamchatka.

Cotylis ventricosus Günther, Cat., III, 1861, p. 498 (copied).

Cyclopterichthys ventricosus Jordan and Gilbert, Synopsis 1883, p. 745 (after Steindachner).—Garman, Discoboli, 1892, p. 41.—Jordan and Evermann, Fishes of North and Middle America, II, 1898, p. 2104; St. Paul Island, Pribilof, Petropaulski.—Jordan and Gilbert, Fishes of Bering Sea, III, p. 475; Petropaulski, St. Paul, Bering Island, Atka.

Cyclopterichthys glaber Steindachner, Ichth. Beitr., X, 1881, p. 14, pl. VIII; Ochotsk Sea.

Head 3 in length; depth 3½; depth of caudal peduncle 3⅔ in head; length of snout 3; maxillary 2½; eye 6; interorbital space 1⅘; D. 9; A. 7; P. 20.

Body stout, thick, abruptly compressed behind; the head broad, depressed, slightly convex on the crown; the snout blunt, broadly rounded when seen from above. Mouth wide, the angle on a line passing about midway between tip of snout and eye, the lower jaw projecting beyond the upper; teeth small, simple, pointed, close set; in 2 prominent series, the outer ones minute, especially on posterior part of lower jaw; 3 or 4 large teeth form a third rather indefinite inner series on front of jaws. Eye lateral, much nearer to tip of snout than to gill opening. Gill slit about 5 in head, with a rounded flap.

Spinous dorsal wanting, the soft dorsal short, inserted on the tail. Anal similar to the dorsal in shape, inserted a little behind it. Pectoral 1⅔ in head; the lower part of its base extends far forward below. Ventral disk nearly round, with a broad, free margin, its longitudinal diameter contained about 1⅛ times in head, its center on a perpendicular passing about midway between eye and gill opening.

Color dark olive, with numerous small, round, black dots on the upper parts. Posteriorly the dots coalesce forming indistinct, irregular, narrow bands or reticulations.

Described from an example from Aomori, 170 millimeters long exclusive of the caudal fin which is broken. The specimen was presented by Mr. Sotaro Saito. Of 2 specimens from the Pribilof Islands, 1 has very small spots scarcely distinguishable from the general dark color; the other is similar in color to the Japanese example.

Bering Sea and southward to northern Japan.

Family II. LIPARIDIDÆ.

THE SEA SNAILS.

Body more or less elongate, tadpole-shaped, subcylindrical anteriorly, compressed behind, the head depressed; both head and body covered with smooth, thin skin, which is very lax. Head broad, obtuse, the snout short, wide, and blunt; third suborbital bone styliform behind, forming a bony stay articulating with the preopercle, as in *Cottidæ;* mouth moderate, anterior, terminal, the jaws equal, or the lower included; jaws with bands of small teeth, which are simple or more or less tricuspid, usually close set, forming a pavement; no teeth on vomer or palatines; premaxillaries protractile, little movable; opercular bones unarmed; interopercle slender, ray-like, overlying the branchiostegals; gill openings small, the membranes joined to the broad isthmus and to the humeral arch below. Branchiostegals 6. Gills $3\frac{1}{2}$, no slit behind the last; pseudobranchiæ small or wanting; dorsal fin rather long, the spines feeble and flexible, low, similar to the soft rays; anal long, similar to the soft dorsal; ventral fins I, 5, the two completely united and forming the bony center of an oval sucking disk, or else sometimes entirely wanting; pectoral fin very broad, the base procurrent, extending forward under the throat, the outline usually emarginate, some of the lower rays being produced; tail diphycercal; caudal fin short, convex; vertebræ numerous, 35 to 50; pyloric cæca numerous; no air bladder; stomach siphonal, U-shaped, intestine elongate. Small, sluggish fishes, nearly all of the Arctic seas, a few belonging to the Antarctic; found adhering to rocks at various depths. The group is evidently closely allied to the *Cottidæ*, and its origin must be sought in the ancestors of such types as *Psychrolutes* and *Cottunculus*, the *Cyclopteridæ* representing a coordinate phase of degradation.

LIPARIDINÆ.

a. Ventral disk present, large or small.

b. Ventral disk normal, composed of 13 lobes, a median one in front and one corresponding to each of the fin rays, each lobe with a deciduous horny covering or papilla. Teeth close set in pavement-like bands, tricuspid in the young, some or all becoming angular or bluntly arrow-shaped in the adult; caudal fin well developed, rather broad.

c. Dorsal fin continuous, the spines not separated from the soft rays.

d. Nostrils, 2 on each side, the posterior in a more or less distinct tube.

e. Tip of snout without barbels ..... *Liparis*, 3.

ee. Tip of snout with several barbels or tubular projections; substance of body translucent ..... *Crystallias*, 4.

3. LIPARIS (Artedi) Scopoli.

SEA SNAILS.

Liparis ARTEDI, Genera, 1738, p. 117 (nonbinomial).
Cyclogaster GRONOW, Museum, 1763, p. 157, (nonbinomial).
Liparis SCOPOLI, Introd. Hist. Nat., 1777, p. 453 (*liparis*).
Liparis CUVIER, Règne Anim., 1st ed. 1817 (*liparis;* not *Liparis* Ochsenheimer, 1810, a genus of *Lepidoptera*).
Cyclogaster GRONOW, Cat. Fishes, Gray ed., 1854, p. 40 (*liparis;* not of Macquart, 1854, a genus of flies).
Actinochir GILL, Proc. Ac. Nat. Sci. Phila., 1864, p. 193 (*major*).
Careliparis GARMAN, Discoboli, 1892, p. 56 (*agassizii*).
Lyoliparis JORDAN and EVERMANN, Check-List Fishes, 1896, p. 451 (*pulchellus*).

Body rather elongate, covered with smooth skin, which is usually freely movable; head short, flattened above; mouth horizontal, the jaws equal or the lower jaw included; teeth in several series, close set, always more or less tricuspid, the adult with the outer cusps often worn or obliterated; maxillary covered by skin of preorbital region; anterior nostrils present, tubular or not; posterior nostrils usually tubular, no barbels or tubes at tip of snout, ventral disk well developed on the breast, its front below or behind the middle of the head, its surface with 13 lobes; an anterior median lobe, and 1 corresponding to each of the 6 rays in each fin; each lobe with a horny papilla covering, which is sometimes lost; vent well behind the head, about midway between the sucking disk and anal fin; dorsal fin continuous, undivided, its spines not differentiated; caudal well developed; dorsal fin free from caudal or joined; pectoral broad, procurrent at base, emarginate and free at tips, some of the lower rays produced; vertical fins enveloped in the lax skin; vertebræ 35 to 55. Northern seas near the shores; the species less arctic in distribution and in general inhabiting shallower water than is the case with *Careproctus* and *Paraliparis*, a fact associated with the reduced number of vertebræ in *Liparis*. The species are numerous, but in general well defined, their characters varying with age. In most of the species color varieties occur, several (*pulchellus*, *liparis*, *aleuticus*, *agassizii*) having the body often marked everywhere with concentric curved stripes or rings. (λιπαρός, sleek-skinned.)

3. LIPARIS AGASSIZII Putnam.

Cyclopterus liparis BLOCH, Ausländ. Fische, I, 1785, p. 48, in part; Pacific specimens.
Liparis agassizii PUTNAM, Proc. Amer. Assoc. Adv. Sci., 1874, p. 339; Sakhalin, Channel of Tartary (Coll. Pierce and Smith).—GARMAN, Discoboli, p. 62, 1892, pls. I–III.—JORDAN and EVERMANN, Fish. North and Middle Amer., II, 1898, p. 2121; Bristol Bay, Alaska.—JORDAN and GILBERT, Fish. Bering Sea, III, p. 473; Bristol Bay.—JORDAN and SNYDER, Proc. U. S. Nat. Mus., 1900, p. 369; Hakodate.
Liparis gibbus BEAN, Proc. U. S. Nat. Mus., 1881, p. 148; Unalaska, St. Paul Island, Indian Point, Cape Chaplin, and Plover Bay, Siberia.—JORDAN and GILBERT, Synopsis, 1883, p. 741.
Liparis ? pulchellus ISHIKAWA, Prel. Cat., 1897, pp. 36–37; Hakodate, Sakhalin.

Head 3½ in length; depth 4; length of snout 3⅕ in head; diameter of eye 7½; width of interorbital space 3; D. 44; A. 34; P. 34.

Body elongate, compressed posteriorly, about as wide as deep anteriorly. Head large, interorbital space broad and flat. Mouth large, the maxillary extending nearly to middle of eye; lower jaw included; teeth tricuspid, in oblique rows, forming broad bands on the jaws. Anterior nostril with a large tube, the posterior with a low rim. Gill opening extending a short distance below upper edge of base of pectoral, its width contained 3 times in head.

Dorsal and anal fins enveloped in loose skin and gelatinous tissue, the anterior rays hidden from view; dorsal inserted above posterior edge of ventral disk, its distance from tip of snout about 3 in body; anal inserted farther back, its distance from snout about 2 in body; both dorsal and anal joined to the caudal, the tips of the posterior rays separated by a shallow notch. Posterior edge of pectoral rounded, 4 or 5 of the lower rays elongate, their free tips extending beyond margin of fin; length of pectoral about 5 in head. Ventral disk nearly round, with a broad, free border, its diameter contained about 2¼ times in head.

Skin smooth; distinct pores on upper jaw, no barbels.

Color in spirits pale brownish with dark markings. The color varies considerably; some specimens are almost translucent, the sides with dusky clouds, the fins edged with blackish; other individuals have irregularly shaped, dark spots on the sides or dusky vertical bands beginning near median line and extending to edge of dorsal fin; an example from Hakodate has many narrow purple bands extending from snout to caudal fin.

North Pacific; common south to Unalaska on the American side and to Myiako in Rikuchu on the Japanese. It is especially abundant about rocks around Hakodate Head. Our numerous Japanese specimens are from Otaru, Hakodate, Aomori, and Myiako. The original types were collected by Messrs. Pierce and Smith at Sakhalin, Channel of Tartary.

(Named for Prof. Louis Agassiz.)

4. CRYSTALLIAS Jordan and Snyder, new genus.

Crystallias JORDAN and SNYDER, new genus (*matsushimæ*).

Allied to *Liparis*, differing in the diaphanous body which is strongly compressed, and especially in the possession of a number of barbels on the jaws. The presence of barbels distinguishes it from *Crystallichthys*, which it very closely resembles.

(κρυστάλλος, crystal.)

4. CRYSTALLIAS MATSUSHIMÆ Jordan and Snyder, new species.

Head $4\frac{1}{5}$ in length; depth $4\frac{1}{6}$; snout $3\frac{1}{4}$ in head; eye $3\frac{1}{2}$; interorbital space $2\frac{3}{4}$; D. 58; A. 51; P. about 31.

Body and head markedly compressed; upper profile of head rather abrupt in front; mouth inferior, oblique; the maxillary extends to a point below anterior part of iris. Teeth small, trilobed; the lateral lobes minute, larger on posterior teeth, scarcely discernible or absent on anterior ones. Eye large, directed laterally, situated a little nearer to tip of snout than to gill opening. Snout apparently without pores; three or more small, fleshy barbels on each side of upper and lower jaws; those on upper jaw slightly longer than those below, both groups located on the part of jaw anterior to angle of mouth. Nostral single, with a large tube located in the position occupied by the anterior nostril in *Liparis*. Gill opening small, entirely above base of pectoral fin. No lateral line can be detected.

Fin rays enveloped in a gelatinous, fleshy covering which grows thinner posteriorly where the rays are more exposed to view. Dorsal fin beginning just above gill opening, the rays growing gradually

FIG. 2.—CRYSTALLIAS MATSUSHIMÆ.

higher posteriorly to near the caudal fin, where they become shorter; anal inserted behind beginning of dorsal, a distance equal to one-half the length of head, similar in shape to dorsal; both dorsal and anal continuous with caudal, the latter rounded posteriorly. Pectoral large, its edge divided by a shallow notch, the two parts thus separated being broadly rounded; the fin extends forward below to the anterior middle portion of ventral disk. Ventral disk small, round; its edge free.

Color translucent; head and body with narrow dark bars and oblong spots. The bars, 7 to 8 above, 5 below, have their origins near median line of body, where they are darkest and better defined; passing outward they become less distinct and disappear near edges of fins. A row of 4 or 5 spots on upper edge of fin, 2 spots near middle of body, several spots and bars on upper part of head.

The species is represented by a single specimen 120 millimeters long, in a bad state of preservation, the skin in many places torn from the body. It is not evident whether the posterior border of the pectoral is entire or notched, or whether the dorsal and anal are partly separated from the caudal.

Type.—No. 49802, U.S.N.M., collected by the United States Fish Commission steamer *Albatross* in the Bay of Matsushima, station 3773, at a depth of 78 fathoms.

(*Matsu*, pine; *shima*, island.)

Supplementary note.—In the Museum of Hakodate is another species of *Liparididæ*, called Kokkoda, from Kayabe in Hokkaido. It is probably a species of *Neoliparis* Steindachner, a genus distinguished from *Liparis* by the separation of the dorsal spines from the soft rays by a notch.

The specimen examined was $4\frac{1}{2}$ inches long: D. about VI, 30; P. about 24. Disk round, $1\frac{2}{3}$ in head. Gill opening extending downward to base of uppermost pectoral ray; nostrils all similar, each with a raised rim. Dorsal free from caudal; anal slightly connected. Body very limp, pale in color. The species is allied to the Californian *Neoliparis mucosus*. It is to be hoped that some Japanese naturalist may find and describe this species.